Title: **Design of energy management services for prosumer communities**

Description

The energy world is in a state of revolution. Renewable sources have to be developed and exploited, in order to reduce dependency on fossil fuels and to counteract the climate changes posed by growing worldwide energy demand. Distributed energy generation is becoming more and more important, but it also poses some major challenges to the current energy system. Development of smart grids has a high priority in order to cope with these challenges and also to increase the efficiency of the energy grid. ICT is an enabling technology for the implementation of smart grids.

At a micro level the role of households, as passive consumers, changes more and more into active participants in the energy system by installing generation facilities at their own premises (i.e. PV panels, wind mills, micro-CHPs). Besides using energy they also produce their own energy, thus becoming *prosumers*. The surplus is delivered back to the central grid. There is a trend that prosumers organize themselves in local energy communities, exchanging energy at a local level, thus becoming more independent from the incumbent energy companies. In the end full independence may result in a local autarkic energy system, also called micro-grid or virtual power plant.

The realization of such local energy communities is still in its infancy. On their road towards self-sufficient communities, many steps still have to be taken, both organizational and technological. Individual prosumers, as well as *prosumer communities*, need the support of ICT based services, in order to locally trade supply and demand and to monitor and control the energy flows. Real time data management, information and control services, billing services, customer management services, etc. need to be developed.

The assignment

Wim Timmerman is working as a researcher at the Research and Innovation Centre – Energy of the Hanze University of Applied Sciences. As such he is doing his PhD research on *"the development of energy management services that support prosumer communities in their evolutionary growth path".* He is looking for ICT BSc or MSc students that would like to participate in his research by doing their BSc resp. MSc thesis. The assignment will be based on work of former graduate students. The exact content of the assignment is open for discussion with Wim Timmerman.

The assignment involves (amongst others) the following subjects:
1. **State-of-the-art prosumer communities**: many initiatives are currently emerging in the Netherlands, and some are related to smart gird pilot projects. What is the status of these initiatives with respect to the level of organization and (technical) energy management service support?
2. **Elaboration of service concept**: an initial service concept for the provision of energy management services has been described, based on SOA and web services. This service concept has to be elaborated. Which framework of components is needed to fully support individual prosumers and prosumer communities during their evolutionary growth path? What are the design criteria and constraints for a successful service design process for such evolutionary developments, based on literature?
3. **Design and implementation of a number of example services (prototyping)**. TNO created a development platform for "plug-and-play" inclusion of both smart services and smart appliances. This platform can be used to develop and demonstrate a number of example prosumer community services..

Required background
Preferably an ICT Software Engineering BSc or MSc student(s), with affinity with the energy field, who likes to participate in this research project by doing his/their BSc resp. MSc thesis. Experience with the following development environments is a pre:

- Java
- OSGi (Apache Felix platform),
- Bndtools
- Experience with web development
- Google Web Toolkit (GWT)

Students: Max. 2 students
Period: February –June 2013
Payment: to be decided
Location: Hanze University

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